

Before the
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

In the Matter of)

The Establishment of Policies and)
Service Rules for the Non-Geostationary)
Satellite Orbit, Fixed Satellite Service)
in the Ku-Band)

IB Docket No. 01-96

REPLY COMMENTS OF SKYBRIDGE

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August 6, 2001

No. of Copies rec'd 019
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SUMMARY

In the instant NPRM, the Commission proposed four alternative frameworks for NGSO/NGSO sharing in the Ku-band. The comments in this proceeding demonstrate that only Option III squarely meets all of the Commission's stated objectives. As noted by the majority of applicants for Ku-band NGSO systems, Option III provides the most effective and efficient means for sharing among the proposed systems. The option leaves all operators free to use all of the spectrum for as much of the time as possible, requiring coordination and mitigation measures only during "in-line" events. Option III also permits technology and service choices to be dictated by the market, not by the Commission. It prevents spectrum warehousing by avoiding the need to reserve either spectrum or orbital resources for systems that may never launch. Finally, it aids systems in obtaining landing rights around the world, and in coordinating with non-U.S. licensed systems.

Moreover, the objections to Option III raised by certain parties are all based on significant misconceptions regarding that proposal. Most importantly, neither satellite diversity nor uniform transmitter power is required for implementation of Option III. A system with no satellite diversity capability whatsoever will still have access to a greater amount of spectrum than under any of the other technology-neutral options proposed. While uniform power levels would simplify implementation of Option III, varying power levels can be easily accommodated by customizing the definition of in-line event, an approach that SkyBridge and others support.

As the comments demonstrate, the other options proposed in the NPRM -- Options I, II and IV -- suffer from a number of flaws. Chief among these are that they:

(1) fail to provide licensees certainty that they will have equal access to sufficient spectrum to support economically-viable broadband services; (2) encourage spectrum warehousing; (3) minimize or eliminate opportunities for more efficient coordination; and (4) impose design constraints on the systems that would impede the provision of innovation services and competition among systems.

The same is true of the variations on these options proposed by various commentors. Virtual Geo's proposal to give systems employing its "Virgo" orbit exclusive access to nearly half of the spectrum does nothing but promote Virtual Geo's business objectives for its patented orbit, to the substantial detriment of all other applicants and the public interest. The Virtual Geo proposal quite clearly violates a large number of the Commission's stated objectives, including that the rules should: (1) ensure that all applicants have both equal and sufficient access to spectrum; (2) prevent spectrum warehousing; (3) facilitate the systems' coordinated use of their spectrum assignments; (4) achieve an outcome dictated by the service market rather than by regulatory decision; and (5) not favor any particular technology or operation method.

Moreover, Virtual Geo's own analysis demonstrates that it is wholly unnecessary to grant the Virgo system exclusive access to spectrum. In its sharing proposal, Virtual Geo not only states that it can operate in less than half of the available spectrum, but offers to do so. Yet, as Virtual Geo acknowledges, each system operating under an Option III regime will nearly always have access to at least half of the available spectrum (and usually all of the available spectrum). Virgo would therefore be constrained in its spectrum use only in the event of in-line configurations involving three or more systems, the likelihood of which Virtual Geo finds so remote *that it proposes*

ignoring the possibility altogether in analyzing sharing scenarios. In sum, according to Virtual Geo's own studies, the Virgo system can operate under Option III without any significant system modifications, and without any significant reduction in capacity. There is no reason for the Commission to carve-out separate spectrum for the Virgo system, or to require other NGSO systems to take any special measures -- other than those inherent in Option III -- to protect the Virgo system.

While Boeing agrees with SkyBridge that Option III is the preferred spectrum-sharing approach, Boeing also proposes a variation of the band segmentation techniques of Options I and II, in the event the Commission for any reason declines to adopt Option III. However, under the Boeing proposal, a system would likely have to coordinate with other NGSO operators in order to gain access to bandwidth adequate to support a broadband system. Development of sharing rules sufficient to avoid the need for coordination and to prevent disputes would negate the advantages of Boeing's proposal. Moreover, given the fact that each licensee could claim primary access to only $1/N$ of the spectrum (N being the number of NGSO licensees), it is very likely that the financial markets would assume that this represents the actual amount of spectrum a system will be able to productively use. This alone could thwart investment in these systems.

Finally, Hughes' proposal to delay the proceeding indefinitely, until all of the applicants can reach a multi-party coordination agreement, is a prescription for failure. It ignores the dramatically different states of development of the systems in this proceeding, the need for expeditious licensing to foster investment and build-out of the

more advanced systems, and the clear incentive for some applicants to delay the progress of others.

Finally, PanAmSat's argument that the Commission must ensure -- prior to licensing -- that all applicants collectively meet the aggregate EPFD_{down} limits must be rejected. As the Commission has already determined, it will take a good deal of time before violation of the aggregate limits could be of legitimate, practical concern, and final development of the methodologies for assessing compliance with these limits has not been completed by the ITU-R. Furthermore, it is impossible for any given applicant to demonstrate or certify now as to the aggregate conduct of multiple future operational systems. As SkyBridge explained in its comments in this proceeding, what the Commission can do at this time is include in each license a statement putting the licensees on notice that, once a fourth system seeks to commence operations, the Commission may require all of the operating licensees to collectively demonstrate compliance using the most relevant ITU-R methodology approved at that point in time.

TABLE OF CONTENTS

	PAGE
SUMMARY	i
TABLE OF CONTENTS	v
I. INTRODUCTION	2
II. SPECTRUM SHARING OPTIONS.....	3
A. Options I and II – Flexible and Dynamic Band Segmentation	3
B. Option III – Avoidance of In-Line Interference Events	4
1. General Considerations.....	4
a. Option III does not require implementation of satellite diversity.....	5
b. Option III does not require use of uniform transmitter power.....	9
c. Option III encourages a negotiated solution, while at the same time allowing all projects to proceed without delay.....	10
2. Implementation.....	12
C. Option IV – Homogeneous Constellations.....	16
1. General Considerations.....	16
2. Virtual Geo Proposal.....	16
a. Virtual Geo’s orbit is not superior to other NGSO orbits.....	18
b. Band segmentation is not required to license all the systems in this processing round, including the Virgo system.....	20
c. The Virtual Geo proposal would leave many NGSO FSS systems with insufficient spectrum for economically-viable operation.....	21
d. The Virtual Geo proposal violates the objectives articulated by the Commission in the <u>NPRM</u>	22
D. Boeing Proposal.....	23
III. SERVICE RULES.....	25
CONCLUSION.....	29

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REPLY COMMENTS OF SKYBRIDGE

SkyBridge L.L.C. ("SkyBridge"), by its attorneys, hereby replies to the comments on the Notice of Proposed Rulemaking ("NPRM") filed by various parties on July 6, 2001 in the above-captioned proceeding.¹ This proceeding will develop the service rules for non-geostationary satellite orbit ("NGSO") Fixed-Satellite Service ("FSS") systems in the Ku-band, including the rules for frequency sharing among the multiple applicants for such systems.²

¹ FCC 01-134, rel. May 3, 2001 (the "NPRM"). See Comments of SkyBridge ("SkyBridge Comments"); Comments of Teledesic LLC ("Teledesic Comments"); Comments of The Boeing Company ("Boeing Comments"); Comments of Virtual Geosatellite LLC ("Virtual Geo Comments"); Comments of Denali Telecom LLC ("Denali Comments"); Comments of Hughes Communications, Inc., as amended July 12, 2001 ("Hughes Comments"); Comments of DirecTV, Inc. ("DirecTV Comments"); Comments of PanAmSat Corporation (PanAmSat Comments"); Comments of Lockheed Martin Corporation ("Lockheed Martin Comments").

² See also In the Matter of Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems in the Ku-Band, First Report and Order and Further Notice of Proposed Rulemaking in ET Docket No. 98-206, RM-9147, and RM-9245, released December 8, 2000 (the "Report & Order"). SkyBridge has previously commented on many of the issues in the instant NPRM in related proceedings. With respect to the service rules for NGSO FSS systems, see, e.g., , ET Docket No. 98-206, RM-9147, and RM-9245, Comments of SkyBridge, March 2, 1999 ("SkyBridge NPRM Comments") and Reply Comments of SkyBridge, April 14,

I. INTRODUCTION

The Commission has proposed four alternative frameworks for NGSO/NGSO sharing. The comments in this proceeding demonstrate that, while each of the proposals has certain advantages and disadvantages, only Option III squarely meets all of the Commission's stated objectives in this proceeding. The other options suffer from a number of flaws. Chief among these are that they: (1) fail to provide licensees certainty that they will have equal access to sufficient spectrum to support economically-viable broadband services; (2) encourage spectrum warehousing; (3) minimize or eliminate opportunities for more efficient coordination; and (4) impose design constraints on the systems that would impede provision of innovative services and competition among systems.

The same is true of the variations on these options proposed by various commentators. As demonstrated below, Virtual Geo's proposal to give systems employing its "Virgo" orbit (a highly elliptical or "HEO" orbit) exclusive access to nearly half of the spectrum does nothing but promote Virtual Geo's business objectives for its patented

1999 ("SkyBridge NPRM Reply Comments"), SkyBridge Petition for Reconsideration, March 19, 2001 ("SkyBridge Petition for Reconsideration"). See also In re applications of The Boeing Company, File No. SAT-AMD-19980108-00006 et al., Comments and Consolidated Petitions to Deny and/or Hold in Abeyance of SkyBridge L.L.C., June 30, 1999 ("SkyBridge Petitions to Deny") and Reply of SkyBridge L.L.C., August 16, 1999. With respect to NGSO/NGSO sharing regimes, see, e.g., Ex Parte Presentation of SkyBridge, "Methods for sharing between NGSO systems in the Ku-band," November 8, 2000; Ex Parte Presentation of SkyBridge, "Co-Frequency Sharing by NGSO FSS Systems in the Ku-band," November 30, 2000 ("SkyBridge Nov. 30, 2000 Ex Parte"); Ex Parte Presentation of SkyBridge, "NGSO/NGSO Sharing," February 28, 2001 ("SkyBridge Feb. 28, 2001 Ex Parte"); and Ex Parte Presentation of SkyBridge, "Implementing 'Home Zone' as a Default Solution for Ku-Band NGSO/NGSO Sharing," March 27, 2001 ("SkyBridge March 27, 2001 Ex Parte"). See also In the Matter of Applications of SkyBridge L.L.C., File No. SAT-AMD-19990108-00004, et al., Motion for Expedited Licensing, July 20, 2000.

orbit, to the substantial detriment of all other applicants and the public interest. Boeing proposes a variation on band segmentation (as a fallback option to Boeing's stated preference for Option III), which would permit all licensees to operate on a secondary basis in bands not assigned to them. While this proposal constitutes an improvement over Options I and II as proposed in the NPRM, in the end it fails to overcome significant problems inherent in any band segmentation approach. Finally, Hughes' proposal to delay the proceeding indefinitely, until all of the applicants can reach a multi-party coordination agreement, is a prescription for failure. It ignores the dramatically different states of development of the systems in this proceeding, the need for expeditious licensing to foster investment and build-out of the more advanced systems, and the clear incentive for some applicants to delay the progress of others.

II. SPECTRUM SHARING OPTIONS

A. Options I and II – Flexible and Dynamic Band Segmentation

The commentors in this proceeding overwhelmingly rejected Options I and II, which involve alternative methods of segmenting the available bands of spectrum among the applicants in this proceeding. First, these options would not provide the licensees regulatory certainty that they would have access to nearly enough spectrum for economically-viable broadband systems.³ Second, these options introduce the likelihood that the spectrum available to a given licensee actually would decrease with time, counter to business requirements.⁴ Moreover, these approaches may create insurmountable

³ See SkyBridge Comments at 7; Virtual Geo Comments at 29-30; Hughes Comments at 8-9; Denali Comments at 7.

⁴ See SkyBridge Comments at 7; Hughes Comments at 10.

problems in coordinating with systems licensed by other administrations.⁵ As noted by Hughes, these options also would result in a reduction of useable spectrum, due to the need for numerous guard bands, and would limit carrier sizes and access methods.⁶ The Commission should therefore reject these options.

B. Option III – Avoidance of In-Line Interference Events

1. General Considerations

As noted by the majority of applicants in this processing round, Option III provides the most effective and efficient means for sharing among the proposed systems.⁷ As explained by Teledesic, this approach leaves all operators free to use all of the spectrum for as much of the time as possible, requiring coordination and mitigation measures only during "in-line" events. In contrast, Options I and II decrease the amount of spectrum each operator can use, even when no interference would result from each system using the full band.⁸ Option III also permits the technologies used and services provided to be dictated by the market, and not by the Commission.⁹ It prevents spectrum warehousing by avoiding the need to reserve either spectrum or orbital resources for

⁵ See SkyBridge Comments at 9; Virtual Geo Comments at 30.

⁶ Hughes Comments at 3. As Hughes explains, "the extremely narrow segments likely in this case would cause the aggregate amount of guard-band spectrum to be disproportionately large relative to the applicants' useable spectrum in each sub-band, thereby utilizing the allocated spectrum very inefficiently." *Id.*

⁷ SkyBridge Comments at 16-18; Boeing Comments at 1-2; Teledesic Comments at 2-3; Denali Comments at 2-4.

⁸ Teledesic Comments at 2.

⁹ Denali Comments at 3-4.

systems that may never launch.¹⁰ Finally, it aids systems in obtaining landing rights around the world, and coordinating with non-U.S. licensed systems.¹¹ As concluded by Denali, it "has the flexibility to achieve, and best promotes, the objectives of spectrum sharing over other options, without the need for drastic changes by each of the applicants to the designs of their proposed systems."¹²

Moreover, the parties that opposed Option III base their objections on a number of significant misconceptions regarding that proposal. Indeed, as demonstrated below, while Virtual Geo strongly opposes Option III, its own analysis demonstrates that the Virgo system would have greater spectrum access under Option III than under its own proposal, without any significant impact on its system design or operation.

a. Option III does not require implementation of satellite diversity.

Virgo argues that Option III "would have merit if it did not require compulsory satellite diversity and uniform transmitter power from all operators."¹³ However, neither satellite diversity nor uniform transmitter power is required for implementation of Option III.

As SkyBridge has explained on numerous occasions, while satellite diversity could aid a system in making even more productive use of the available

¹⁰ Teledesic Comments at 3.

¹¹ Teledesic Comments at 3.

¹² Denali Comments at 2.

¹³ Virtual Geo Comments at 20. Virtual Geo supports Option III as appropriate for all systems other than its own, see id. at 22, but claims that it is not appropriate for its Virgo system because this option requires satellite diversity and its system does not have that capability. However, as demonstrated below, *both* of these claims are erroneous.

spectrum within an Option III approach, its use is absolutely not required.¹⁴ A system with no satellite diversity capability whatsoever will still have access to a greater amount of spectrum than under any of the technology-neutral options proposed.¹⁵

Virtual Geo argues that Option III “imposes extreme cost penalties and spectrum inefficiencies for systems that do not require satellite diversity,” and “could double system deployment costs for these systems.”¹⁶ Virtual Geo’s argument is wrong, particularly with regard to its own system.

In its comments, Virtual Geo states that “in-line interference events among three or more systems simultaneously are very rare.”¹⁷ Indeed, Virtual Geo states that its simulations show that *“the probability of more than two systems experiencing a significant in-line interference event is so small – 0.01% of the time – that it can reasonably be ignored as a factor.”*¹⁸ As Virtual Geo acknowledges, this means that

¹⁴ See, e.g., SkyBridge Nov. 30, 2000 Ex Parte at 8-11; SkyBridge Feb. 18, 2001 Ex Parte at 17; SkyBridge March 27, 2001 Ex Parte at 17-18. Under Option III, each affected system must reduce its spectrum use during an in-line event with another system. Satellite diversity provides a system with an alternative: The system can either reduce its spectrum use with the affected satellite, or transfer the traffic from that satellite to other satellite for the duration of the in-line event. As seen below, however, the capacity of systems that already plan to use less than half of the spectrum would be unaffected during such an event, even without use of satellite diversity or other mitigation measures.

¹⁵ See SkyBridge Comments at 17, n.36. Therefore, under Option III, satellite diversity functions exactly as Virtual Geo proposes: Satellite operators would be permitted to “use diversity when it suits them as an alternative or supplement to any plan involving use of non-homogenous satellite networks.” Virtual Geo Comments at 23-24.

¹⁶ Virtual Geo Comments at 20.

¹⁷ Virtual Geo Comments at 21.

¹⁸ Virtual Geo Comments at 21-22, n.22 (emphasis added). Virtual Geo states that its interference study “did not find a single instance of three-system simultaneous in-line

each system operating under an Option III regime will nearly always have access to at least half of the available spectrum (and usually all of the available spectrum).¹⁹

Virtual Geo's motivation in opposing Option III is, therefore, very puzzling. In its proposed variation on Option IV, Virtual Geo not only stated that it can operate in less than half of the spectrum, but it offered to do so. Therefore, Virtual Geo will have access to more than the amount of spectrum it has stated that it needs, essentially all of the time. It would be constrained in its spectrum use only in the event of in-line configurations involving three or more systems, the likelihood of which Virtual Geo finds so remote *that it proposes ignoring the possibility altogether in analyzing sharing scenarios*.²⁰

In sum, ***according to Virtual Geo's own studies, the Virgo system can operate, under Option III without any significant system modifications, and without any significant reduction in capacity.*** Most of the time, Virtual Geo would have access to more spectrum than would be the case under its own proposal, and it would essentially never have less than its stated requirements. There is no reason for the Commission to carve-out separate spectrum for the Virgo system, or to require other NGSO systems to

interference in a month of time simulating five systems simultaneously.” Virtual Geo Comments, Appendix 1, at 4. Virtual Geo concludes that “any interference protection scheme need only protect against two-satellite interference events, provided that adequate statistical independence exists in the spatial behavior of the various constellation designs, and provided that the links in question use reasonably narrow beam masks as [employed in the study].” *Id.* At 4.

¹⁹ Virtual Geo Comments at 21-22, n.22.

²⁰ Virtual Geo Comments, Appendix 1, at 4.

take any special measures – other than those inherent in Option III -- to protect the Virgo system.²¹

Moreover, even if this were not the case, Virtual Geo's claims regarding its inability to employ satellite diversity are greatly exaggerated.²² A simple examination of the Virgo system shows that Virtual Geo will always have two satellites visible to any given earth station, and could therefore employ satellite diversity. Although one of these satellites may be lower than Virtual Geo's stated 40° minimum elevation angle, it appears that Virtual Geo already must operate lower than this angle in order to serve equatorial regions. It therefore appears that Virtual Geo does have at least some diversity capability. This is consistent with the statements of the other applicant for a HEO system, Denali, that its system has some satellite diversity capability.²³

However, *even if Virgo chooses to ignore the flexibility inherent in its system*, Virgo's own comments demonstrate that its system can operate successfully under an Option III approach, without employing satellite diversity. Therefore, with or without satellite diversity, Virtual Geo's claims that Option III is incompatible with its system are entirely without foundation.

²¹ Virtual Geo continues to argue that if it must share with other types of NGSO systems, those systems should employ their satellite diversity capability to protect Virgo-like systems. See Virtual Geo Comments at 25. See also Denali Comments at 5. Not only is there no valid technical or policy reason for singling out one kind of NGSO architecture for special treatment, with Option III, there is no need to do so.

²² For example, Virgo argues that its costs could double if it were required eliminate interference events entirely by using satellite diversity. See, e.g., Virtual Geo Comments at 24, n.27.

²³ Denali Comments at 2.

b. Option III does not require use of uniform transmitter power.

Virtual Geo's claim that Option III requires uniform transmitter power from all operators also is inaccurate.²⁴ As SkyBridge has explained before, uniform power would simplify implementation of Option III, such as selection of a single metric (e.g., 10° angular separation) to define an in-line event between any two systems. However, as Virtual Geo ultimately concedes, varying power levels (and/or antenna patterns) can be easily accommodated by customizing the definition of in-line event, an approach that SkyBridge supports.²⁵

A simple way to do this would be to define two or more separation angles (e.g., 10° and 20°), the larger angles being used in cases of in-line events involving higher-powered transmitters. As discussed further below, even more optimized approaches have been proposed by SkyBridge and Teledesic.²⁶ In these approaches, actual link parameters of each system are employed to compute the optimum separation angle between each of the operating systems. In sum, Option III in no way requires uniform transmitter power from all operators. All proposed systems could be accommodated without in any way constraining their power levels.

Although Virtual Geo claims to have “looked closely at [Option III],”²⁷ it is clear that Virtual Geo either did not understand what it was looking at, or has chosen to be grossly misleading regarding the conclusions that it reached. There is no valid

²⁴ Virtual Geo Comments at 20.

²⁵ Virtual Geo Comments at 22.

²⁶ SkyBridge Comments at 18-21 and Annex 1; Teledesic Comments at 3-9.

²⁷ Virtual Geo Comments at 20.

technical reason whatsoever why all kinds of NGSO systems, including HEO systems, cannot be efficiently accommodated via an Option III approach. As discussed below, the only apparent reason for Virtual Geo's arguments is it hope that it will gain, at the expense of all of the other applicants in this proceeding, exclusive access to the spectrum it seeks, to create a market for its patented orbit.

c. Option III encourages a negotiated solution, while at the same time allowing all projects to proceed without delay.

Hughes argues that the Commission should reject all of the plans on the table, and instead "encourage and assist applicants to share information and to craft a negotiated solution, which is more likely to benefit all planned systems and more efficiently allocate spectrum resources."²⁸ SkyBridge agrees that individual coordination, based on the actual operating parameters of each system, leads to the most effective use of the available spectrum. However, Hughes' proposal is entirely unconstructive in the current scenario, and should be rejected by the Commission.

As SkyBridge has demonstrated repeatedly, the systems proposed in this processing round are at vastly different stages of development. As a result, important design and operational details of many systems are not known, which means that a meaningful coordination cannot take place anytime soon. Equally obvious is the fact that certain applicants have every incentive to delay the progress of those applicants whose system planning, design and financing has progressed the furthest. Put simply, adoption of Hughes' proposal would guarantee substantial delays in the progress of those applicants that are serious about expeditiously deploying their systems.

²⁸ Hughes Comments at ii.

Moreover, Option III achieves the very same goals that are espoused by Hughes. Option III basically provides a "default" solution to govern sharing in the event that coordination agreements are not reached. This option does not preclude in any way a negotiated solution. By placing the fewest possible constraints on the use of the spectrum or on the design of the systems, Option III leaves open numerous possibilities for cooperation in the use of the spectrum, and encourages exactly the types of discussions that Hughes proposes. What appears to trouble Hughes is that Option III also will permit immediate licensing of all systems, thereby fostering investment in, and build-out of, those systems that are real, and expediting the exposure of those systems that are not.

Finally, Option III will save the Commission what would likely be years of involvement in the negotiations Hughes proposes. Once Option III is adopted, the licensees will be free, without the need for Commission oversight or involvement, to negotiate among themselves to optimize the sharing regime. And even if the applicants do not reach individual coordination agreements, they will all have sufficient spectrum to operate, without imposition of significant design constraints.

While obviously no licensing/sharing scheme can accommodate the current round of applicants with zero impact, Option III is the only one that proposes an acceptable solution for all of the applicants, without precluding more carefully-tailored bilateral agreements. Hughes' complaint that it is in no position to decide on any of the four options proposed by the Commission, can, and should, be summarily dismissed.²⁹ Hughes fails to provide any clear demonstration how its system might be disadvantaged

²⁹ Hughes Comments at 6.

in any way under Option III,³⁰ and it fails to propose any concrete alternative that could move the process forward expeditiously. Hughes' objections should be rejected out of hand.

2. **Implementation**

Implementation of Option III requires a definition of an "in-line event." In earlier filings, SkyBridge explained that the simplest approach would be to select an angular separation applicable to all or most of the systems. SkyBridge proposed a 10° benchmark as a simple, but admittedly arbitrary, metric that would lead to adequate protection in nearly all the cases, while still providing clear incentive for further coordination among the operators to increase spectrum efficiency.³¹ Nonetheless, SkyBridge agrees with Virtual Geo that use of 10° angular separation as the sole definition of in-line event would base "the defined interference cone on an overly pessimistic assumption" in many cases.³² As SkyBridge proposed in its comments, the

³⁰ Hughes appears to believe that "full-mesh" systems will be disadvantaged under Option III. Hughes Comments at 4,11. However, Hughes' observations apply to any system, such as H-Net or SkyBridge, which employs a large number of user terminals and plans to use satellite diversity to permit use of all of the spectrum all of the time. Such systems inherently require a great deal of flexibility and sharing capability, which can be used for this purpose. Of all the options on the table, Option III best addresses these concerns. It provides by far the greatest amount of spectrum for each system. Moreover, Option III in no way precludes, and in fact is designed to encourage, coordination among the applicants to take into account specific system features. Hughes' comments are particularly surprising given that its two applications clearly identify satellite diversity as a primary mitigation technique for sharing with other NGSO systems.

³¹ See SkyBridge March 27, 2001 Ex Parte at 11-13.

³² Virtual Geo Comments at 22, n.23; see also Teledesic Comments at 7. As SkyBridge has explained, any attempt to select a cone size that will apply to more than one system will inevitably involve arbitrary decisions. If the Commission chooses this approach, which has the advantage of simplicity, SkyBridge urges the Commission to err on the side of caution when choosing a cone size, even if it is "overly pessimistic"

angular separation needed between systems can be optimized on a case-by-case basis by taking into account actual link parameters.

Such an approach requires adoption of an interference protection criteria, applicable to each of the NGSO systems. As an initial matter, SkyBridge agrees with Teledesic and Virtual Geo that the coordination threshold that applies to GSO FSS inter-network interference limits is not directly applicable to NGSO FSS networks.³³ NGSO FSS systems are characterized by multiple satellites whose positions move with respect to the earth and with respect to satellites of other systems. The interference environment created by such systems is therefore very dynamic, as opposed to the static environment created by GSO systems. Any interference criteria must account for the time-varying nature of the inter- and intra-system interference.

Furthermore, NGSO systems have essentially global coverage, and in most cases their links must be optimized for operation over all the rain zones and a wide range of elevation angles. Therefore, most NGSO systems employ adaptive coding of some sort, and their capacity is dependent on the margin against rain fade or low elevation. This adaptive margin can therefore be used for interference mitigation. As stated by Teledesic, all NGSO FSS systems will have the capability to cope with higher interference levels for short periods of time.³⁴

in many cases. Operators that would like to make more efficient use of the spectrum may coordinate among themselves to customize the rules that apply among them, without the need for Commission intervention.

³³ Teledesic Comments at 4; Virtual Geo Comments at 26-28.

³⁴ Teledesic Comments at 4-5; see also Virtual Geo Comments at 27.

For these reasons, a 6% $\Delta T/\Gamma$ trigger, as used for GSO/GSO coordination, can lead to unnecessary coordination in the NGSO context, and an inefficient use of spectrum resources. In its comments in this proceeding, SkyBridge proposed an approach for defining in-line interference events based on the I/N threshold for synchronization loss. This approach takes into account the time-varying nature of NGSO interference and the ability of NGSO systems to withstand short periods of interference, so long as synchronization loss does not result. Teledesic has proposed a similar approach.

While SkyBridge believes that the Teledesic approach has merits, SkyBridge foresees difficulty in implementing certain aspects of the Teledesic proposal. While SkyBridge agrees that an "in-line" event should be defined based on exceedence of an interference allowance, SkyBridge does not agree that the magnitude of the interference allowance should depend on the number of operational systems, as Teledesic proposes.³⁵ The entry of new system should not upset all the previous coordinations between other operators. That is, while a new entrant will require previous entrants to take steps to implement Option III to handle in-line events with that new system, this should not require the previous entrants to significantly alter the steps already taken to handle in-line events among themselves.

SkyBridge therefore proposes to adopt a unique criterion, which would not depend on the number of NGSO operational systems. Consistent with Teledesic's

³⁵ Teledesic Comments at 6-7. Specifically, Teledesic proposes an interference time allowance of 10% of the time allowance for the BER specified in the short-term performance objectives assuming two systems, a 7% allowance assuming three systems, and a 5% allowance assuming four or more systems.

proposal for three systems, this criterion could be 7% of the time allowance for the BER specified in the short-term performance objectives of the victim network.

Another difference between the Teledesic approach and the SkyBridge approach is Teledesic's use of the methodologies described in Recommendation ITU-R S.1323. While this approach is indisputably the most accurate, and is the preferred approach for full coordinations, it is far too complex for a *default* coordination solution.³⁶ SkyBridge has therefore proposed a simplified approach for use in the present context. SkyBridge's approach is sufficient to determine whether coordination is necessary between two systems, and if so, what angular separation must be maintained to avoid unacceptable interference during in-line events. This is all that is needed for the Commission's default solution. Individual operators may opt for more detailed coordination among themselves to further optimize use of the spectrum (perhaps using S.1323, for example), but this would not be required.

On a final point, Virtual Geo expressed concern that tracking inaccuracy could impede the use of Option III.³⁷ SkyBridge agrees with Virtual Geo that each licensed system should be required to publish up-to-date ephemeris information for all of its satellites in standard format.³⁸ In fact, the Commission has already promulgated such

³⁶ The methodology proposed by Teledesic would consume substantial time and computational resources. It requires use of very detailed and complex interference statistics. It is not appropriate for use as a default coordination, which may be a first step toward further coordination, or a final step when productive dialog among the licensees is, for whatever reason, not possible.

³⁷ Virtual Geo Comments at 25-26.

³⁸ Virtual Geo Comments at 26.

a requirement in its rules, based on the well-tested NORAD model.³⁹ The Virgo system is just another Molniya-type orbit system, and such systems have been successfully tracked in the past with the NORAD model. Furthermore, the approach has been well-tested for use in the measurement process for assessing compliance with the single-entry operational limits applicable to NGSO FSS systems, and has been demonstrated to be sufficiently accurate for both the ITU-R and the Commission.⁴⁰

C. Option IV – Homogeneous Constellations

1. General Considerations

The vast majority of the applicants in this proceeding soundly reject Option IV, which would require them to abandon their current system designs, and, in many cases, their business plans. Each class of constellations has advantages and disadvantages in the marketplace. Restricting the technologies that can be employed will restrict the kinds of services that can be offered and the competition among providers. It will also hamper efforts to compete against other broadband technologies, particularly terrestrial-based services.⁴¹ SkyBridge therefore urges the Commission to reject this approach in any of its variations.

2. Virtual Geo Proposal

Of the parties commenting in this proceeding, only Virtual Geo supports enforced homogeneity.⁴² Virtual Geo continues to argue that “the evident superiority” of

³⁹ Report & Order, ¶ 102.

⁴⁰ See, e.g., SkyBridge Petition for Reconsideration at 35, n.76.

⁴¹ See SkyBridge Comments at 13; Hughes Comments at 14-15.

⁴² Denali also proposes homogeneity, employing the orbit of its Pentriad system. Denali Comments at 4-6. However, Denali concedes that, of the options in the NPRM,

systems employing its particular HEO orbit dictates that these systems should be awarded exclusive use of at least nearly half of the spectrum available for NGSO FSS systems.⁴³

However, as SkyBridge has explained on numerous occasions, the Virgo orbit is *not* superior from a technical or policy standpoint to any of the orbits proposed by other applicants in this proceeding, and suffers from a number of serious drawbacks.⁴⁴

Moreover, as demonstrated above, band segmentation is not needed to accommodate the Virgo system. Finally, the Virtual Geo proposal would threaten the economic viability of the NGSO FSS systems in this processing round. As demonstrated below, ***Virtual Geo's proposal boils down to nothing more than an attempt to create a future market for Virtual Geo's patented orbit.***⁴⁵

Option III best promotes the objectives of spectrum sharing, without the need for drastic changes to the designs of the proposed systems, and acknowledges that its system could operate under such an approach. Denali Comments at 2-3.

⁴³ Virtual Geo Comments at 35. See also Virtual Geo Comments at 31-41. Under Virtual Geo's proposal, NGSO FSS systems that do not employ a HEO orbit that is homogeneous with that employed by the Virgo system would share roughly half of the spectrum allocated for Ku-band NGSO FSS operation, while Virtual Geo, and any applicants that amend their applications to adopt the Virgo orbit, would gain access to roughly another half. A small "growth zone" would remain in between the two assignments.

⁴⁴ SkyBridge Comments at 13-15; See also Hughes Comments at 14-15.

⁴⁵ Virtual Geo envisions "multiple operators using the same technical approach, including large scale production of standardized space segment and earth segment equipment for VGSO use." Virtual Geo Comments at 39. While Virtual Geo obviously has a monetary stake in encouraging such a scenario, it wholly ignores the problems imposed on the marketplace by such an approach, which would limit the types of services available to consumers and thwart competition.

a. Virtual Geo's orbit is not superior to other NGSO orbits.

As SkyBridge demonstrated most recently in its comments in this proceeding, the Virgo orbit is not inherently superior to orbits proposed by other applicants in this proceeding, including LEO, MEO, and other HEO orbits. For example:

- The high operating altitude of the Virgo satellites causes a transmission delay that would impede interactive applications, making it very difficult for such systems to compete with land-based systems, which do not suffer such delays. The delay would also impede use of TCP/IP-transparent architectures, as employed by the SkyBridge system.⁴⁶ Thus, *the delay introduced by a Virgo-type orbit not only irreparably decreases the quality of some highly-interactive services, but it also increases the complexity of the system needed to support important and basic communications protocols used in even less interactive applications.*
- The geometry and tracking strategies of the Virgo constellation put into questions its usefulness for providing global service, particularly service to the tropics.⁴⁷ Indeed, *in its comments Virtual Geo essentially concedes that the orbit is really more appropriate for regional GSO-like services.*⁴⁸
- The chief benefit that Virtual Geo has ascribed to its architecture is its ability to accommodate a large number of homogeneous systems. However, *it has not been demonstrated that maximally-packed homogeneous Virgo constellations yield any greater capacity than maximally-packed homogeneous constellations of any other type, including MEO or LEO systems.*⁴⁹ Nor has it been

⁴⁶ SkyBridge Comments at 13-14. See also Hughes Comments at 14-15.

⁴⁷ SkyBridge Comments at 14.

⁴⁸ Virtual Geo argues, for example, that the Commission should not establish global coverage requirements for Virgo-like systems, due to the nature of their coverage. Virtual Geo Comments at 44-45.

⁴⁹ Virtual Geo continues to argue that "[u]nlike other system proposals, the VGSO model allows for a large number of homogeneous NGSO systems to coexist. . . ." Virtual Geo Comments at 4. However, use of homogeneous orbits of *any type*, including LEO and MEO, greatly increases the number of systems that can be accommodated without the need for other interference mitigation measures. HEO orbits are in no way unique in this regard. A valid comparison must take into account the maximum amount of "nesting" of constellations that can be achieved with a given constellation type, taking into account antenna discrimination and power levels. Then, based on a "a maximally-packed" sky of such constellations, the comparison must assess the capacity and services that could be provided. Simply put, when

demonstrated that the Virgo-type orbit, in which satellites communicate with customers during only a limited portion of their orbits, represents a particularly cost-effective use of satellite resources.⁵⁰

Indeed, the only "problem" that Virtual Geo's proposal "solves" is a problem that does not exist. Virtual Geo proposes to reserve nearly half the spectrum to create "future licensing opportunities" for a single class of NGSO system, only one of which has been proposed to date.⁵¹ Any future demand for such Virgo-like systems, particularly the hundreds of such systems that Virtual Geo envisions, is entirely speculative, even *without* taking into account the considerable disadvantages of the orbit noted above. The numerous applicants hypothesized by Virtual Geo, each clamoring to implement Virgo-like systems, simply do not exist at this time. What the Commission does have is the current round of applicants, proposing a variety of spectrum-efficient, and entirely compatible, uses for this spectrum. As the Commission knows, many of these applicants have expended considerable resources in the effort to turn their proposals into reality, and are far along in the development process. The spectrum requirements of these existing projects should not be thrown aside to warehouse spectrum for a class of systems for which no future demand has been demonstrated.

Thus, the benefits that Virtual Geo ascribes to its system are entirely illusory. As the Commission proposed in the NPRM, the marketplace should decide the

Virtual Geo compares scenarios based on homogeneous Virgo-type orbits to scenarios entailing widely-varying non-homogeneous orbits, it is comparing apples to oranges.

⁵⁰ SkyBridge Comments at 14-15.

⁵¹ Virtual Geo Comments at 35. Denali has also proposed a system employing a HEO orbit. However, not surprisingly, Denali's orbit does not fall within Virtual Geo's narrow definition of the type of system that would enjoy exclusive access to nearly one-half of the available spectrum.

technologies and services of Ku-band NGSO FSS systems. Each of the proposed systems has advantages and drawbacks, and none is inherently superior or more suitable according to any of the Commission's stated policy objectives in this proceeding. A variety of kinds of systems will lead to the greatest diversity in service offerings, and the highest competition among providers.⁵²

b. Band segmentation is not required to license all the systems in this processing round, including the Virgo system.

Moreover, band segmentation and/or homogeneity are not required in order to license all the systems in this proceeding. As shown above, all the systems, *including the Virgo system*, can be accommodated much more effectively under Option III. Indeed, under Option III, the Virgo system would enjoy greater spectrum access than Virtual Geo is now requesting for its system under its proposed variation on the Option IV proposal.

Virtual Geo cites in support of its proposal the approach used to assign spectrum for CDMA and FDMA/TDMA systems in the Big LEO MSS proceeding.⁵³ However, these two cases are in no way comparable. As Virtual Geo notes, in the Big LEO case, band segmentation was required to avoid the intractable interference that would have been caused by incompatible access technologies. This is not the case here.

⁵² See SkyBridge Comments at 10-11. Moreover, Virtual Geo's attempt to secure preferential treatment for its orbit is directly contrary to the international approach to NGSO systems taken by the ITU-R working groups. Internationally, consistent with longstanding U.S. positions, all NGSO orbits are treated identically from a regulatory standpoint. Virtual Geo has offered no compelling reason for the U.S. to abandon its leadership role in these ITU fora and suddenly favor a policy tantamount to band planning.

⁵³ Virtual Geo Comments at 39.

As demonstrated above, all of the systems can be accommodated under Option III without resorting to band segmentation. The Virgo system in particular *does* have the ability to share with other types of systems under this approach, and does not require its own exclusive spectrum. In fact, it appears that the Virgo system would be among the systems least affected by the adoption of Option III, due to Virtual Geo's stated ability to operate in less than half of the available spectrum. There is, in fact, no significant sharing impediment in the instant context, and Virtual Geo's reliance on the Big LEO proceeding is completely without foundation.

c. The Virtual Geo proposal would leave many NGSO FSS systems with insufficient spectrum for economically-viable operation.

The Virtual Geo proposal would threaten the economic viability of the other proposed systems in this processing round, solely to reserve space for hypothetical and entirely speculative future systems that have yet to be proposed. As SkyBridge has demonstrated on numerous occasions, access to less than half of the spectrum allocated for Ku-band NGSO FSS systems would be wholly insufficient for SkyBridge's proposed broadband services⁵⁴ and would thwart SkyBridge's plans for universally-available service in its earliest phase of deployment.⁵⁵ No party has adequately refuted SkyBridge's demonstrations of its spectrum requirements.⁵⁶ Moreover, sacrificing the

⁵⁴ See, e.g., Ex Parte Presentation of SkyBridge, ET Docket No. 98-206, March 23, 2000, SkyBridge FCC Meeting on Operation in the 12.2-12.7 GHz Band ("March 23, 2000 Ex Parte"). Boeing has made similar showings with respect to its system. See Letter to Mr. Donald Abelson from Bruce Olcott *et al.*, ET Docket No. 98-206, RM-9147, RM-9245, Dec. 20, 1999.

⁵⁵ See Feb 18, 2000 Ex Parte at 32-37; March 23, 2000 Ex Parte at 32-34.

⁵⁶ Virtual Geo is simply wrong when it states -- without any explanation or documentation -- that less than half the spectrum "provides each prospective licensee

capacity of all non-Virgo-like systems is entirely unnecessary in order to accommodate the Virgo system.

d. The Virtual Geo proposal violates the objectives articulated by the Commission in the NPRM.

Virtual Geo claims that its approach "may be the only feasible means of accomplishing all of the Commission's objectives."⁵⁷ However, for the above reasons, the Virtual Geo proposal quite clearly violates a large number of the key objectives for the NGSO/NGSO sharing framework articulated by the Commission in the NPRM, including, most importantly, that the rules should:

- "ensure that all applicants have equal access to spectrum;"⁵⁸
- "prevent spectrum warehousing by non-implemented NGSO FSS systems at the expense of operational systems;"⁵⁹
- provide sufficient spectrum capacity for each system;⁶⁰

with sufficient spectrum to fulfill its business plan." Virtual Geo Comments at 40. Moreover, in view of the considerable evidence on the record to the contrary, it is irresponsible of Virtual Geo to claim that "[a] system operator that cannot establish a viable system with nearly 500 MHz of user downlink spectrum is probably not going to be able to operate with sufficient spectrum efficiency to merit award of a license, and probably does not belong in the Ku-band NGSO FSS business in the first place." Design of an NGSO FSS system involves numerous tradeoffs. As SkyBridge has demonstrated repeatedly, the SkyBridge spectrum requirements are needed to enable the system to: (1) share with multiple other systems, including other NGSO FSS systems of diverse architectures; (2) roll-out truly global service in the initial phase of operation in a economically-viable fashion; and (3) support an architecture than permits low transmission delay, thus providing terrestrial-like connectivity. As these clearly are not design criteria of the Virgo system, it is not surprising that SkyBridge's spectrum requirements are different than Virtual Geo's.

⁵⁷ Virtual Geo Comments at 6.

⁵⁸ NPRM, ¶ 17.

⁵⁹ Id., ¶ 18.

⁶⁰ Id., ¶ 20.

- “not . . . preclude, in any way, the NGSO FSS systems’ coordinated use of their spectrum assignments;”⁶¹
- achieve “an outcome dictated by the service market rather than by regulatory decision;”⁶² and
- establish a “regulatory framework that does not favor any particular technology or operation method.”⁶³

In sum, Virtual Geo’s proposal does nothing but promote the business objectives of one applicant in this proceeding at the expense of all others, without advancing the public interest in any demonstrable way. It should be rejected by the Commission.

D. Boeing Proposal

While Boeing states that Option III is its preferred spectrum-sharing approach, Boeing also proposes a variation of the band segmentation techniques of Options I and II, in the event the Commission for any reason declines to adopt Option III.⁶⁴ Under Boeing's approach, each system would have primary status allocation over its reserved piece of spectrum and a secondary status (vis-a-vis other NGSO licensees) in the remaining frequency bands allocated to NGSO FSS systems. Although superior to Options I and II, Boeing's hybrid proposal does not solve several of the significant problems introduced by these options.

⁶¹ Id., ¶ 19.

⁶² Id., ¶ 3.

⁶³ Id., ¶ 16.

⁶⁴ Boeing Comments at 3.

First, Boeing's proposal does not guarantee sufficient spectrum for each system. As with Options I and II, a system would likely have to coordinate with its other NGSO operators in order to gain access to bandwidth adequate to support a broadband system. This is because, in this context of competing systems, each operator could have a strong disincentive to allow sharing of its "primary" spectrum, particularly by a competitor.⁶⁵ Although technically, the primary operator's permission would not be required for another system to enter the band on a secondary basis, in practice, endless disputes regarding interference to primary systems most likely would result. The need for prior coordination to prevent such disputes could only be overcome via the development of detailed and quantitative rules defining the protection requirements of the primary operators, and the limits to be imposed on secondary operators to meet those requirements.⁶⁶ Development of rules sufficient to avoid the need for coordination and to prevent disputes would negate the simplicity of Boeing's proposal, without making up for the spectrum inefficiencies created by rigidly assigning each system a slot of "primary" spectrum.⁶⁷

⁶⁵ As SkyBridge explained in its comments, granting exclusive rights to individual operators is simply an invitation to those operators to protect those rights, to the detriment of its competitors. SkyBridge Comments at 7. As the Commission well knows, the same result can be expected with the grant of primary status.

⁶⁶ While Boeing proposes a technical definition for harmful interference, Boeing Comments at 6 and Appendix A, its definition, based on the GSO/GSO coordination trigger, does not take into account the time-varying nature of NGSO interference or the inherent interference mitigation capabilities of NGSO systems. Moreover, its application would essentially require coordination among operators, and would leave open substantial room for dispute among the competitors.

⁶⁷ The central flaw in Boeing's proposal may be the unstated assumption that each system would have equal incentive to cooperate with its competitors, thereby facilitating sharing. Put another way, if System A needs access to System B's spectrum, System A will see a reciprocal access agreement is the logical solution.

Due to these uncertainties, Boeing's proposal could drastically impede financing of these NGSO systems. Particularly in light of the market's experience over the past year, financial institutions are very sensitive to the consequences of even a seemingly unlikely default scenario.⁶⁸ The fact that, under the Boeing proposal, each licensee could claim primary access to only $1/N$ of the spectrum (N being the number of NGSO licensees), it is very likely that the market will assume that this represents the actual amount of spectrum a system will be able to productively use. This alone could thwart investment in these systems.

Therefore, both the operational and economic impact of the Boeing proposal could be quite severe. As shown below, these disadvantages are all overcome by Option III, a technique that Boeing favors over its own fallback proposal. Therefore, the Commission should decline to adopt Boeing's alternative, in favor of Option III.

III. SERVICE RULES

No party disputes the fact that the aggregate EPFD_{down} limits applicable to all of the Ku-band NGSO FSS systems cannot be exceeded until at least 3.5 NGSO FSS systems are launched and operating co-frequency at full capacity. Nor does any party take issue with the Commission's conclusion that it will take "a good deal of time" before

However, if System B does not need access to System A's spectrum, due to a different technical approach or business plan, the incentive for reciprocity collapses. Given the wide divergence among the systems in this proceeding -- with respect to, inter alia, proposed orbits, stated spectrum needs, descriptions of intended services -- it cannot rationally be assumed that each licensee would be equally motivated to cooperate with its competitors. The sharing scenario therefore cannot rely on such cooperation, but must ensure that each system has access to sufficient spectrum even if cooperation does not materialize. The beauty of Option III is that, no matter how recalcitrant one or more licensees may be, they cannot impose significant adverse consequences on their competitors.

⁶⁸ See also Virtual Geo Comments at 29-30.

an actual violation of the aggregate limits becomes a legitimate concern.⁶⁹ PanAmSat argues that, nonetheless, the Commission must ensure -- prior to licensing -- that all applicants collectively meet these limits. PanAmSat argues that otherwise, "there will be nothing to prevent multiple NGSO FSS systems from constructing their systems, commencing operation, and exceeding the aggregate limits."⁷⁰

PanAmSat's argument, if accepted, would put into question much of the foundation of the Commission's satellite regulations (as well as the technical rules governing numerous other services). What prevents the scenario that PanAmSat envisions are the Commission's rules themselves, as well as the conditions imposed in the licenses it issues. Put another way, what prevents PanAmSat from operating its system with excess power or with antennas that do not comply with Section 25.209 of the Rules, to the detriment of adjacent GSO systems?

The Commission has placed the aggregate limits in its rules, and, as PanAmSat acknowledges, the ITU-R working groups have made considerable progress in crafting suitable methods for assessing compliance with these limits. As in any interference case, whether GSO or NGSO, should a licensee violate either the Commission's rules, or the terms of its licenses, the Commission has numerous tools at its disposal to remedy the situation.⁷¹

⁶⁹ See, e.g., DirecTV Comments at 3 ("DirecTV does not take issue with the specific reasons that the Commission has cited for deferring at this time the crafting of an explicit demonstration requirement with respect to NGSO FSS system compliance with aggregate EPFD limits."); Lockheed Martin Comments at 2 ("Lockheed Martin also believes that the Commission should clarify that the aggregate limit test need only be applied when the fourth and subsequent NGSO systems are considered.")

⁷⁰ PanAmSat Comments at 3.

⁷¹ See 47 C.F.R. §§25.271-25.274; 47 U.S.C. §312; 47 C.F.R. §25.160.

The illogic of PanAmSat's position is illustrated by its claim that "[i]t is imperative that the Commission require each NGSO system to demonstrate compliance with the aggregate limits, and not just have it affirm that it will meet the limits."⁷² However, as PanAmSat goes on to acknowledge, "the aggregate limits are the collective responsibility of all NGSO systems sharing common spectrum."⁷³ Obviously, it is impossible for any given applicant to demonstrate or certify now as to the aggregate conduct of multiple future operational systems. All that can rationally be done now is for each applicant to certify as to its own system's ability to meet whatever conditions are imposed by the Commission to ensure collective compliance with the limits.⁷⁴

Finally, despite the obvious impossibility of any NGSO applicant meeting its demands, PanAmSat argues that a demonstration of compliance with the aggregate limits need not delay licensing.⁷⁵ However, its proposal relies not only on use of sharing techniques that have been demonstrated above to be incompatible with the types of systems proposed (e.g., completion of full coordination among all of the applicants or band segmentation),⁷⁶ but also on use of ITU-R methodologies that have yet to be

⁷² PanAmSat Comments at 2, n.5.

⁷³ Id.

⁷⁴ See SkyBridge Petition for Reconsideration at 43; SkyBridge Opposition at 12. Lockheed Martin argues that the Commission should incorporate methodologies for assessing compliance with the aggregate limits at the same time as it considers the service rules and spectrum sharing requirements. Lockheed Martin Comments at 1. However, as noted above, Lockheed Martin also acknowledges that the ITU-R methodologies it proposes for incorporation in the Commission's rules have not been finalized. See id. at 2.

⁷⁵ PanAmSat Comments at 3-5.

⁷⁶ See supra Sections II.A, II.B.1.c.

finalized. PanAmSat's proposal would involve simulations of systems that have yet to be adequately defined from an operational standpoint, many of which may never even be built and deployed. Furthermore, the showing PanAmSat seeks would fail to take into account the contributions of non-U.S. systems. In the current context, with systems at drastically different stages of development, any requirement that the applicants collectively demonstrate compliance with the aggregate limits would impose insurmountable obstacles on the serious applicants in this proceeding, and would clearly lead to unacceptable delays.⁷⁷

Indeed, GSO operator DirecTV accepts the Commission's reasons for deciding that a demonstration of compliance with the aggregate limits is premature. DirecTV proposes that a demonstration requirement be implemented at some appropriate point in the process, and that compliance be made an express condition of the licenses of the NGSO FSS systems.⁷⁸ SkyBridge has proposed a similar approach. As SkyBridge explained in its comments in this proceeding, what the Commission can do at this time is include in each license a statement putting the licensees on notice that, once a fourth system seeks to commence operations, the Commission may require all of the operating licensees to collectively demonstrate compliance using the most relevant ITU-R

⁷⁷ On a related point, PanAmSat expresses concern that Option III could lead to a violation of the aggregate limits if the aggregation of non-in-line events is not taken into account. PanAmSat Comments at 6. However, the techniques used by the NGSO systems to share spectrum with each other are entirely separate from the requirements of those systems to comply with the aggregate limits. Quite clearly, the fact that Option III focuses on the mechanisms that NGSO systems will employ to share among themselves during in-line events in no way diminishes the collective responsibility of the operating systems to meet the aggregate limits at all times.

⁷⁸ DirecTV Comments at 3.

methodology approved at that point in time.⁷⁹ Such an approach takes into account the current immature state of development of many of the systems, as well as of the compliance procedures themselves, while fully protecting the GSO operators operating in the shared bands in the event that more than three NGSO FSS systems commence co-frequency operation.⁸⁰

CONCLUSION

In order to foster the provision of innovative satellite broadband services to all Americans, the Commission should quickly license the applicants in the current Ku-band NGSO FSS processing round. This should be accomplished in a manner that provides business and regulatory certainty that all licensees will enjoy equal opportunities to build and launch their systems, as designed in accordance with their individual business plans, with access to sufficient spectrum for broadband applications. Of the

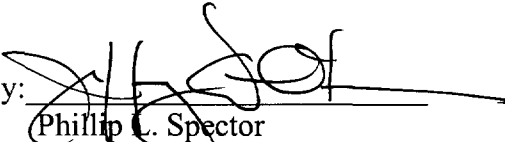
⁷⁹ SkyBridge Comments at 26.

⁸⁰ On the other hand, Virtual Geo's proposal that only non-Virgo-type systems should have their authorizations conditioned on compliance with the aggregate EPFD_{down} limits is patently ridiculous and should be rejected by the Commission. Virtual Geo Comments at 52. All NGSO FSS systems will contribute to the aggregate interference generated, and no type of system should be excluded from the collective obligation to ensure that the adopted limits are met.

Commission's proposals in the NPRM, only Option III meets these important goals, and SkyBridge urges the Commission to proceed expeditiously to adopt that approach.

Respectfully submitted,

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August 6, 2001